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intervals throughout the survey area (Table 5.6). Although the total area covered by the north–south transects was almost double the size of the area covered by the transects from which artefacts were systematically collected inside the field systems, the former yielded only a tiny fraction of the finds (in the ratio of 1:44). The maximum density encountered in the field system was *c.* 124,000 sherds and lithics per ha for WF4.2.5 (the equivalent of more than 10 sherds per sq. m), while the highest density figure recorded in the line walking was the equivalent of 1600 lithics and pot sherds per ha. In Figure 5.43, the density values have been averaged for 500 × 250 m areas in proportion to the area actually surveyed. The higher density of material within and in close proximity to field systems in general is clear. Most of the higher density blocks away from field systems are the result of a transect line crossing a site. While various explanations can be advanced to account for the high sherd densities in and around field systems – including the long-term focus of settlement and farming in this part of the landscape – we believe that the overall volumes appear to have been significantly enhanced by the disposal of household waste for the purpose of manuring the fields, as discussed in Chapter 10 especially.

After inputting the information into the GIS environment, the distributions of this material could be quickly generated for the field groups in a number of different forms, such as density of objects per field, or raw number distributions, or period-based distributions of pottery types according to sherd numbers or sherd weights. Although the densities of surface sherds in the field systems were high compared with the rest of the survey area, the numbers of identifiable fine-ware sherds were generally very low. In some cases the fine-ware sherds in a particular field might be fragments from a single vessel dropped and broken there, but the analysis of the data base suggests that the probability of this phenomenon explaining the fine-ware distributions is low: whilst the sherds are often of the same fabric, except in the case of the Nabataean finewares, they are commonly from identifiably-different vessel types.

The overall distribution of pottery (total number of sherds) across the WF4 field system illustrates the unevenness in the material, already observed in the field work, with low (1–15) sherd numbers in many of the fields and significant concentrations or 'hot-spots' in three zones: WF4.1–WF4.3; WF4.6–WF4.7, and parts of the adjoining Unit WF4.5; and WF4.13 (Fig. 5.44). Density maps of numbers of 'clicked' sherds, pottery weights, and total sherd numbers in the eastern sector of the WF4 field system (Units WF4.1–WF4.12) bring out further detail, confirming the two 'hot-spot' regions here but also demonstrating considerable variations according to the measure used (Figs 5.45–5.47). High densities of pottery could reflect a variety of processes: activity associated with a particular domestic or funerary site; manuring processes, with particular land being selected for greater investment (Wilkinson 1982); processes of soil erosion and floodwater movement; and methodological biases. Separating these processes is difficult. In the case of the 'hot-spot' centred on Units WF4.6–4.7, our fieldwork methodologies might account for some of the frequency: this was in the zone selected for the pilot survey in 1996 because it had not yet been disturbed by recent ploughing, and soil deflation may have increased the visibility of the sherds on the surface compared within the surrounding fields. However, manuring in antiquity may also have shaped the artefact distributions in this central area, because in terms of topography and soil coverage this is – and probably was – one of the most agriculturally favourable parts of the field system. The frequencies in and around Unit WF4.13, especially of prehistoric pottery, certainly relate to the fact that this zone was a focus for intensive settlement in the Early Bronze Age (Chapter 8, §8.6). The WF4.1–WF4.3 hotspot is probably explained by its adjacency to Khirbat Faynan and thus its prime accessibility for manuring with waste from the settlement. The range of material in these fields chimes with the evidence for Khirbat Faynan being a long-lived settlement, and it is likely that this part of the field system was an important agricultural resource for its community throughout its history.

5.8 The palimpsest landscape

This chapter has described the methods used to record and analyse the structural sequence and function of the different components of the field systems. The development and operation of the Wadi Faynan field systems were clearly an intricate and detailed story, that we shall try to illustrate in period-by-period detail in Chapters 8–10. The evidence available to us includes: the distribution of particular water-management structure types; the distribution of channels and channel networks; individual field morphology; the distribution of surface artefacts; the analysis of wall construction; the presence and potential associations of other structures with the fields; the position of tributary wadis and evidence of their past locations; and excavations. The principal outcome of the analysis of this evidence is the strong indication it provides of the variety of floodwater farming techniques, of different ages and complexity from the Bronze Age to (at least) the Byzantine period, but all designed to harness, control, entrain, and distribute surface water flowing down wadi channels after flash floods.

The systems to the north of the main wadi course, that is WF406, WF408, WF409, WF424, WF442, and WF443, are very different from the WF4 system in wall structure and field layout. In terms of water-management technology, all of the systems except WF424 are located along the line of small tributary wadis that have cut shallow valleys through the hills down to the main Faynan channel (Barker *et al.* 1999: 274), and are dominated by simple cross-wadi walls or check dams some of which, as will be argued below and in Chapter 8, are likely to be Bronze Age in date. The fields of WF406 indicate at least three cross-wadi wall systems superimposed one on top of the other (Fig. 5.48). One of these appears to have

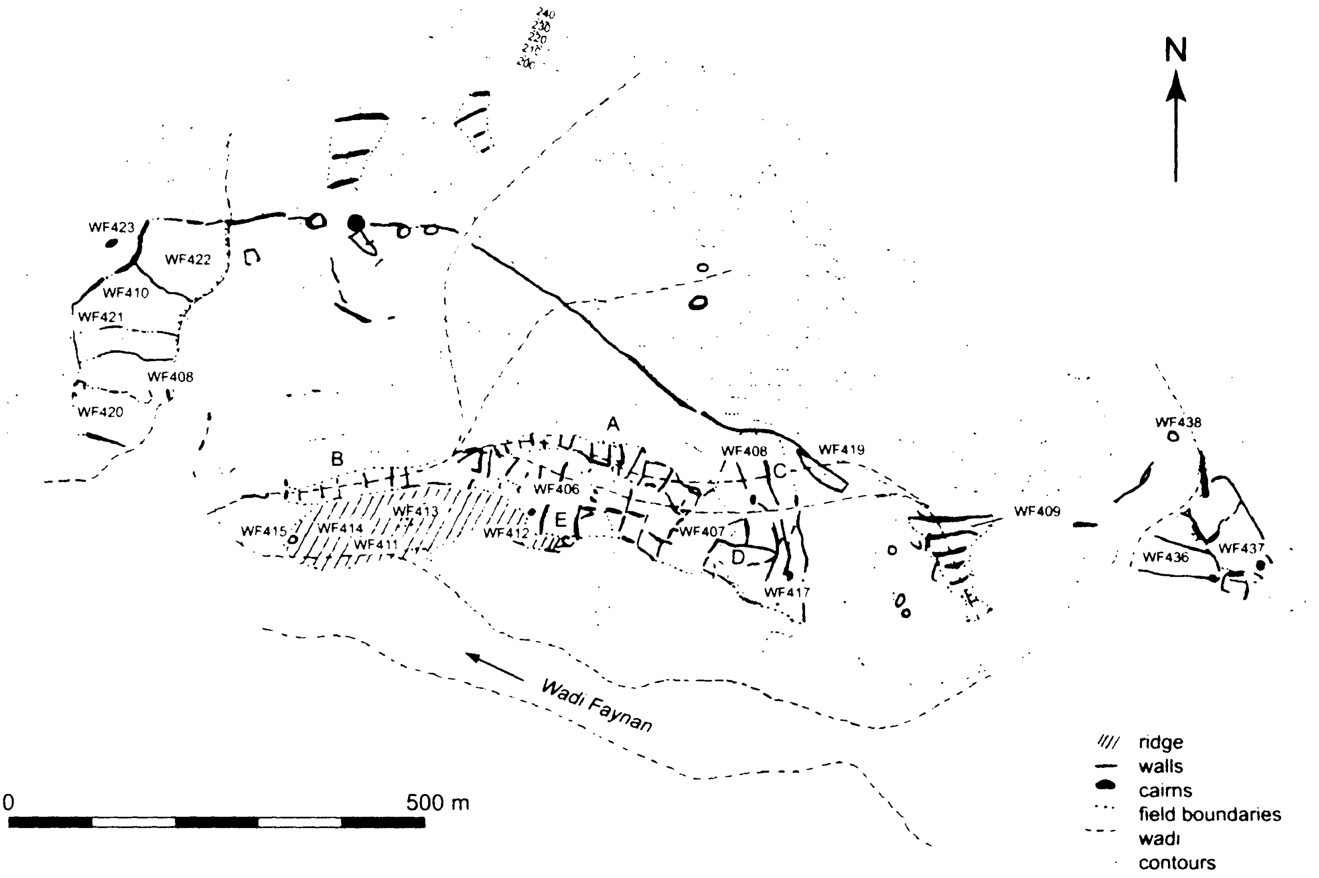

Figure 5.48 *The palimpsest landscape of WF406 and related sites (see text for discussion). (Illustration: Debbie Miles and Lucy Farr.)*

consisted of large, high, and wide walls, forming a series of banks of cairn-like rubble (Fig. 5.48: areas C, D, and E). On top of these banks, and between them, were narrower walls on the same north–south alignment, at right angles to the water flow. By contrast, the walls in areas A and B were check-dams consisting of simple lines of orthostatic boulders (Fig. 8.28). Some Classical-period sherds were collected from regions C, D, and E of WF406, but most of the pottery from these areas was of Iron Age date. In contrast, the few sherds of pottery from areas A and B of WF406 were of Bronze Age date, as was the majority of sherds from WF442. The distributions of period-specific sherds suggest an Iron Age date for the large wall-banks in WF406, and a Classical date for the narrower walls superimposed upon them, with the single lines of orthostatic boulders probably representing the remnants of simpler systems dating to the Bronze Age.

Similar groups of simple check-dams are located within the main WF4 field systems, especially across small tributary channels in the western part of the system where the topography is gentler and water flow would have been slower than on the steeper ground. Other check dams and simple diversion walls were found to the south of the WF4.13 unit in similar topographical situations (Fig. 8.24). In all these cases there were numbers of Bronze Age sherds on the adjacent surfaces, in statistically significant correlations with the adjacent walls, suggesting that these walls are likely to be remnants of Bronze Age fields and floodwater farming systems (Chapter 8). Substantial fragments of orthostatic boulder walls in Units 4.13 are likely to be associated with the major Early Bronze Age settlement WF100 (Fig. 8.12). Similar boulder alignments in parts of Unit WF4.12 appear to have been re-used as the foundations of walls built later, probably in Roman/Byzantine times.

The main walls in the WF4 field system indicate different forms of run-off and floodwater irrigation: a marginal zone exploiting localized rainfall and surface run-off from higher elevations, and a primary zone enhancing the available irrigation water from rainfall and run-off with channelled floodwater deflected out of shallow streams and gullies (Fig. 5.49). It must be stressed that both areas appear to have depended on irrigation related to the exploitation of seasonal rainfall, rather than from continuous spring-fed irrigation. Most of the simple surface run-off systems are on the more steeply terraced fields at the southern edges of the field system. The fields in these zones are smaller than those at lower elevations, arranged in narrow terraces to limit erosion and retain sediment, with a variety of sluices and spillways being used to guide rainwater down the terraces. Iron Age sherds were found lodged within a terrace wall of one of these systems in WF4.2.18, which was overlain by a rubble wall associated with Classical pottery (Fig. 5.50), suggesting that the origins of the terraced run-off systems might also lie in the Iron Age,

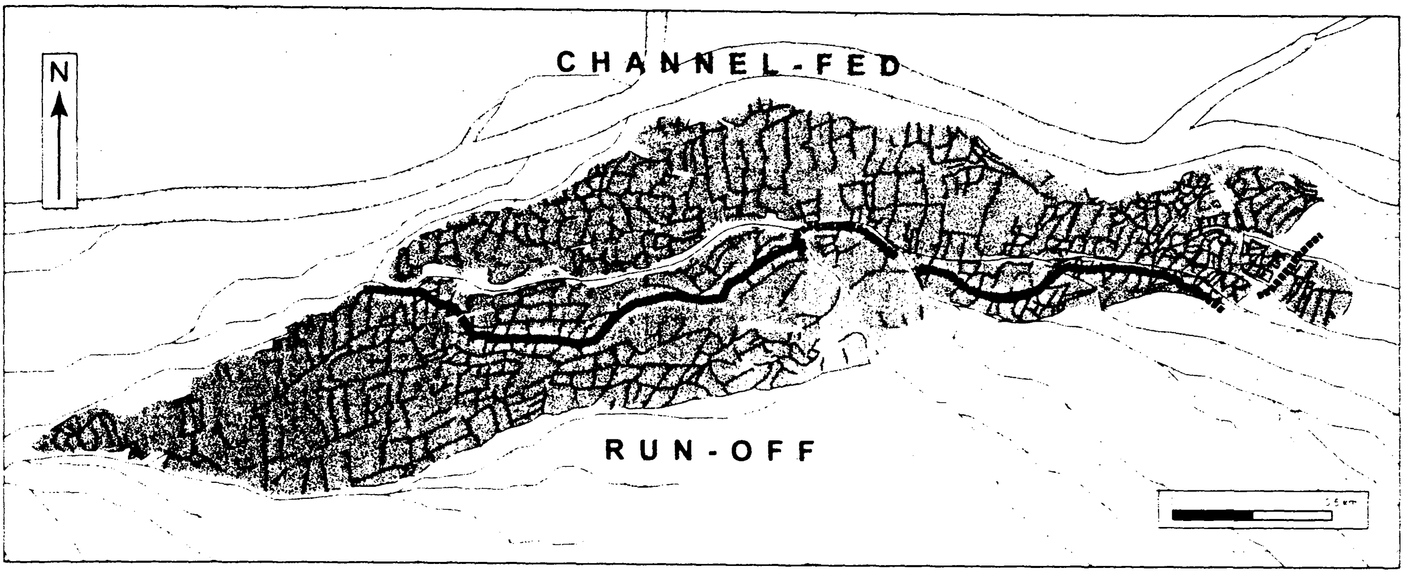

Figure 5.49 Schematic map of areas primarily using channelled floodwater and run-off water. (Illustration: Paul Newson.)

Figure 5.50 A buried terrace wall in WF4.2.18 (visible in the section on the right of the picture) in which Iron Age sherds were lodged, overlain by a rubble wall associated with Classical pottery, looking northeast. (Photograph: Graeme Barker.)

though these fields were certainly used extensively in ensuing periods. The channel technology may also be of similar antiquity: the channel formed along the high perimeter walling of Unit WF4.4, capturing floodwaters at the highest point upstream and using them to irrigate the area immediately adjacent to the capture wadi, certainly has parallels with the major diversion walls in WF406 thought to be of Iron Age date.

As with the majority of field-terrace systems, most of the channel systems would appear to date to Classical times. Such systems transported stormwater from tributary wadis to distant parts of the field system well away from the point of capture, especially on the relatively level northern parts of the WF4 field group near the main channel of the Wadi Faynan (where normal run-off flow between adjacent fields may have been sluggish). Placing their development and main phase or phases of use more accurately within this substantial time period (over a thousand years, spanning the later centuries of the first millennium BC and the first half – at least – of the first millennium AD) is very problematic, but the combination of wall data, artefact distributions, and excavations allows some tentative conclusions. The distribution of terraced walls with a subsidiary wall in front correlates broadly with the distribution of Byzantine sherds; large cairns and burial sites correlate in particular with the distribution of sherds of Bronze Age date (Fig. 5.51); and the distributions of rectangular structures also correlate strongly with those of Early Roman Nabataean pottery (Fig. 5.52).

Figure 5.51 *The distribution in the WF4 field system of Bronze Age and Iron Age sherds, and of cairns and burials. (Illustration: Paul Newson.)*

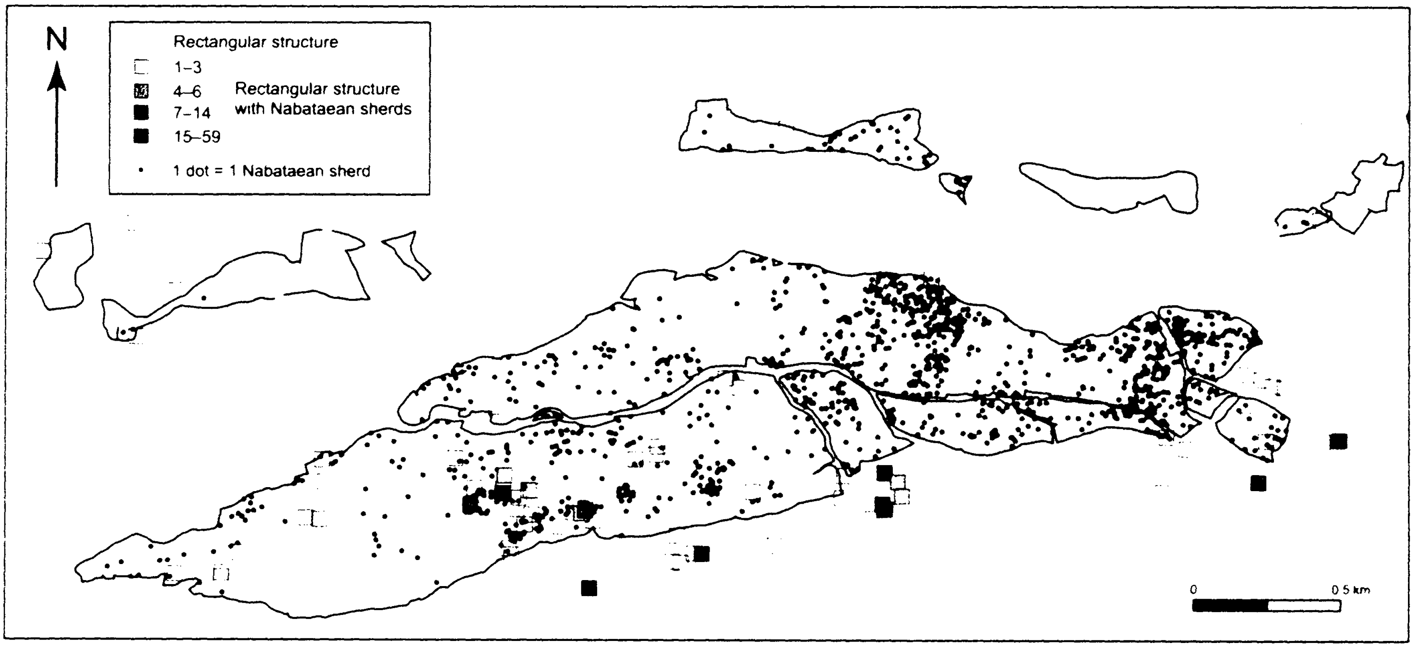

Figure 5.52 *Distribution in the WF4 field system of Early Roman/Nabataean sherds, and of rectangular structures. (Illustration: Paul Newson.)*

Mapping the ratio of field areas to perimeter lengths, whilst in part reflecting factors such as topography (with small linear fields clustering in terraced areas for example), indicates that there are groups of fields with very similar ratios, and thus design, in different parts of the WF4 field system (Fig. 5.54). Notable groups of fields with similar attributes, such as within Units 4.7, 4.9, and 4.12, are suggestive of a broad template in field design, which in turn implies a broadly contemporaneous construction for each group.

The GIS reveals varied densities of surface finds for a succession of chronological periods, varied distributions of different types of technological infrastructure such as sluice and channel networks, and correlations between distinct groups of fields with comparable structural and area attributes, either as discrete entities (such as WF410 and WF442) or as self-contained groups of contiguous fields within WF4. Further information to aid interpretation of individual fields or groups of fields is provided by environmental factors such as local topography, soils, geology, slope, and predicted water flows. Most of the smaller field groups, with perhaps the exception of WF424, appear to represent distinct individual units of fields with similar attributes, designed for a particular suite of floodwater farming methods and constructed within a discrete period

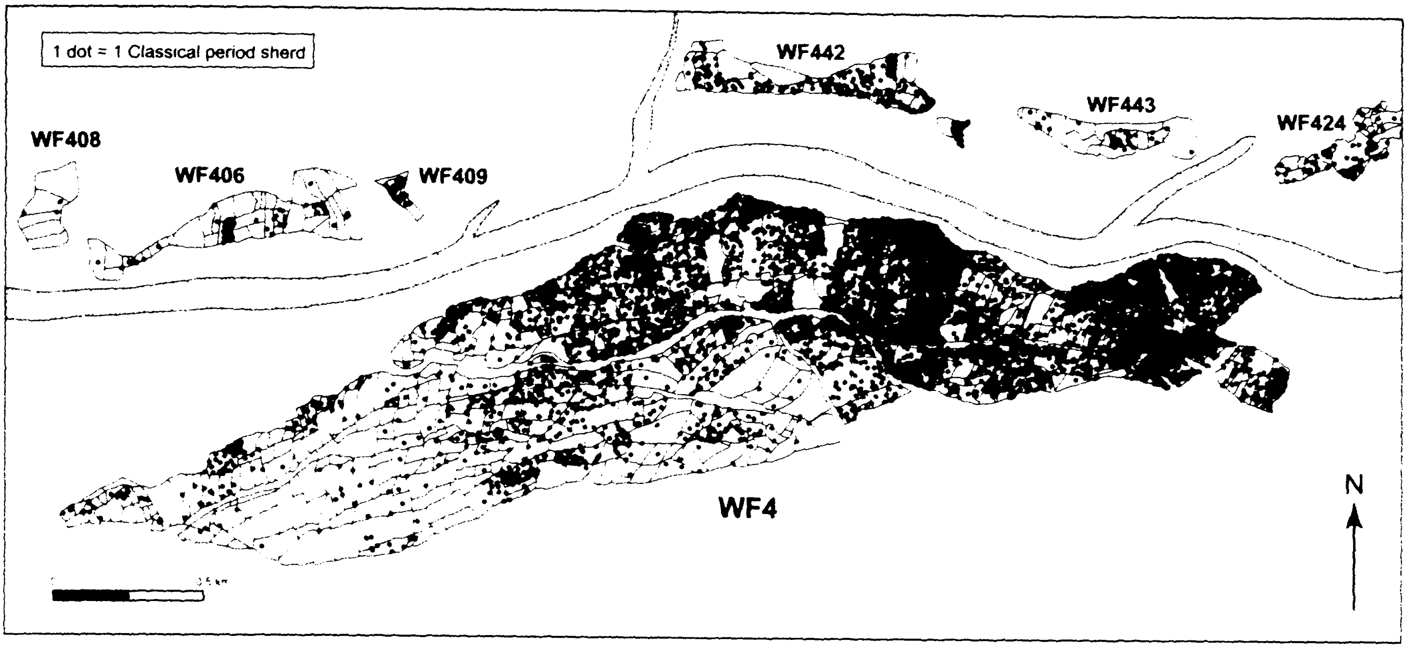

Figure 5.53 *Overall distribution of Classical sherds in field system WF4. (Illustration: Paul Newson.)*

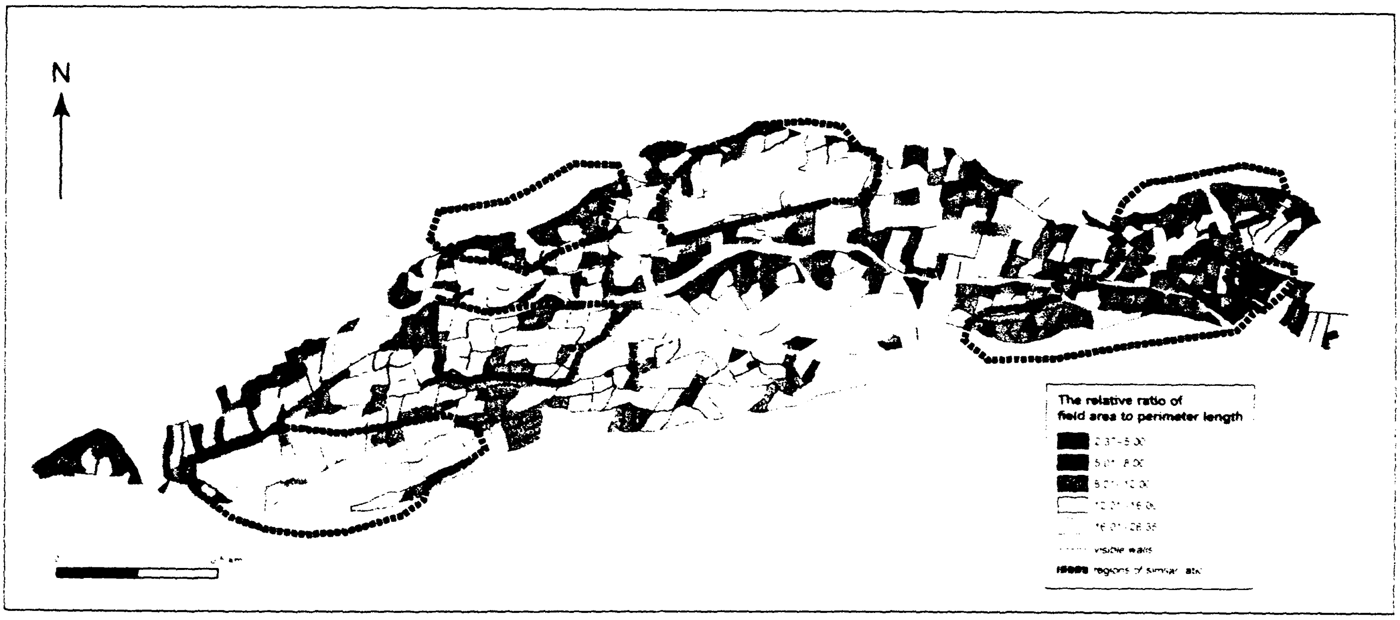

Figure 5.54 *Map of the ratio between field area to perimeter length for WF4. (Illustration: Paul Newson.)*

of time, though subject to re-use and adaptation later. The heterogeneous WF4 field system, on the other hand, clearly incorporates a number of disparate elements with distinct histories of development and function. Thus some parts of the system have significant clusters of cairns, and some have large burial cairns incorporated into later structures, whereas other parts of the system have few cairns. Several zones (the western part of WF4.18, for example) have coherent systems of walls and related structures of similar construction and function.

A number of processes, both cultural and environmental, has clearly been responsible for this spatial and chronological variability, with changing agricultural and/or socio-cultural considerations interacting with changing environmental configurations. The arid nature of the environment has ensured that the erosive and depositional actions of water have been both dominant and uneven. The infrequent and intermittent flash floods and ephemeral streamflows mean that in some years there is a greater potential for a higher volume of water and associated transportation of sediment than in others, with varied effects on the fields in terms of incision by tributary wadis and the shifting of sediment carried across the fields by channel flow and surface run-off, as well as by aeolian processes (Grattan *et al.* 2007). The layout of fields, construction of walls and associated structures, and technologies employed to harness, control, and transport the floodwaters of tributary wadis, all had to be adapted to combat and balance these changes. Socio-cultural factors such as changing forms of ownership and land-use strategies were equally important, the intricate diversion systems and network channels of the Classical period suggesting particularly complex and unifying organizational factors characterized by the sharing of water resources, whether by cooperation or coercion (Barker 1999: 289–90; and see Chapter 10, §10.4.11).

Whilst we can clearly discern change in the construction and use of the 'field' walls of Wadi Faynan, it is important not to assume that change was necessarily linear or constant. Relatively short time periods of rapid change may have been followed by periods of little change. The variability within the WF4 field system, with indicators of multi-period development in some parts but more restricted phases of construction and use in others, is strong evidence for its non-linear development. Some zones, perhaps initially developed outside prime areas for run-off or floodwater farming and for primary purposes other than farming, or in periods when water-control techniques were not as sophisticated as in others, may not have been used on a continuous basis, whereas the central zone (Units 4.6–4.9) appears to have provided attractive conditions for floodwater farming in several phases. Explanations of relatively short-term use may help explain the dearth of surface finds in some parts of the WF4 field system, though different farming practices and erosion histories also have to be taken into account. Nevertheless, the principal trend that can be discerned from the analysis of all the various categories of information from the WF4 field system described earlier in this chapter is one of increasing complexity over many periods in terms of size, methods of construction, and water-management technologies. As described in Chapters 8–11, constant negotiation between the actions of people and physical processes helped sculpture the dynamic landscape of WF4, creating a palimpsest that we have only begun to disentangle but which certainly represents a complex conglomeration of several field groups and systems superimposed one on top of the other, developed at different times for different purposes.